

## ARRANGEMENT FOR LOCKING AND UNLOCKING A DOOR OF A CONTAINER

### BACKGROUND OF THE INVENTION

#### a) Field of the Invention

The invention is directed to an arrangement for locking and unlocking a door of a container, in particular containers for transporting wafer-shaped objects, with locking elements within the door which can move in and out and which, when moved out, penetrate into recesses of the container to be closed. The invention is especially applicable in the semiconductor industry, but can also be used in the manufacture of flat display screens. A technical solution of this kind is known from U.S. Pat. No. 4,995,430, for example.

#### b) Description of the Related Art

For the purpose of charging semiconductor processing installations, so-called SMIF boxes are frequently used as magazine containers in which semiconductor wafer magazines can be stored and transported. The box can be placed on an opening mechanism in an enclosure which encloses one or more work stations so as to keep them free of dust. The box and opening mechanism have closing elements which are adapted to one another and which can be opened simultaneously one above the other so that dust particles resting on the outside of the closing elements can be enclosed therebetween when the semiconductor wafer magazines are lowered into the enclosure together with the two closing elements. The box itself encloses the opening formed in the enclosure.

The locking mechanism disclosed in U.S. Pat. No. 4,995,430 for opening and closing a SMIF box of this kind operates in consecutive steps in which a locking mechanism occupies three different positions. The first position corresponds to a moved-in state and the second position corresponds to a fully moved-out state. In the fully moved-out position, the closing of the SMIF box is effected by a tilting of the locking element, which is constructed as a lever, so as to prevent particles generated by friction from occurring in the locking region. However, the formation of particles is not prevented in the regions of actuation, since wedges are pushed under the other end of the lever in order to tilt the locking mechanism.

The technique of SMIF boxes is especially suited for semiconductor wafers with conventional smaller diameters. In view of the material characteristics of the semiconductor wafers, these SMIF boxes and the semiconductor wafer magazines used with them are becoming increasingly less suitable as transporting containers as the diameter of semiconductor wafers increases. Transporting containers which simultaneously perform the function of magazines are already known for semiconductor wafers of this type. Removal and charging of the semiconductor wafers is effected individually in a plane parallel to the surface of the semiconductor wafers, wherein the transporting container can be closed by a container cover which is directed substantially at right angles to the removal and charging plane. Accordingly, in contrast to the SMIF box, the container cover is removed and inserted laterally rather than in a downward direction.

Current known transport containers which are also subject to the requirement that particle formation be avoided when opening and closing have the disadvantage that the container cover can often only be opened with difficulty, if at all. For a dependable operation, known locking and unlocking elements which act separately and which have favorable results with respect to clean rooms due to their vacuum actuation

and the possibility of encapsulation must be provided with sensors which signal a failure. Moreover, overcoming failures in automated operation results in additional costs.

### OBJECT AND SUMMARY OF THE INVENTION

Therefore, the primary object of the present invention is to increase operating reliability when locking and unlocking in a simple manner such that an opening and closing of the transport container in automated operation is ensured. Particle generation is to be reduced at the same time.

In an arrangement for locking and unlocking a door of a container, in particular containers for transporting wafer-shaped objects, with locking elements within the door which can be moved in and out and which, when moved out, penetrate into recesses of the container to be closed, this object is met in that the penetration of the locking elements into the recesses is effected along a curved path.

A curved path of this kind can be advantageously produced by technical means without the use of wedges. For this purpose, every locking element is connected with the outwardly directed wall of the door by couplers which are rotatably supported in parallelogram construction at the locking element and also at the wall so that, as a result of the couplers, there is a determined distance between the locking element and the wall in the moved-in state, which distance decreases when the locking elements are moved out until the latter contact a contact surface in the recess.

After the locking elements have reached the state in which they contact the contact surface in the recess without significant frictional effects, the locking element is finally fixed so as to be pressed upon under tension so that the container with the door is closed.

In an advantageous manner, locking elements which are adjacent to one another are a structural component part of a plate which is directed parallel to the outwardly directed wall of the door, wherein all plates share a common drive for displacing elements which acts in the locking and unlocking direction, the plates being fixed in the moved-in end position and in the moved-out end position by means of these displacing elements.

For reasons relating to space requirements, it can also be advantageous if every locking element is a structural component part of a plate which is directed parallel to the outwardly directed wall of the door, wherein all plates share a common drive for displacing elements which acts in the locking and unlocking direction, the plates being fixed in the moved-in end position and in the moved-out end position by means of these displacing elements.

In either case, the displacing elements can be constructed as connecting rods, one end of which is rotatably fitted to a plate, the other end being rotatably fitted opposite thereto at a disk so as to lie outside the axis. The plates are fixed in the moved-out end position by rotating the disk beyond the dead center position.

The invention will be explained more fully in the following with reference to the schematic drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 shows a top view of a door with an arrangement for locking and unlocking in a first construction in the moved-in state;

FIG. 2a shows a sectional view of the arrangement in the moved-in state;

FIG. 2b shows a sectional view of the arrangement in the moved-out state;